

(description of fruit from this collection); 2.5 miles west and 2 miles north of Andrix, Las Animas County, Colorado, July 20, 1947, *Rogers 4951*; 8 miles northeast of Kim, Las Animas County, Colorado, May 31, 1948, *Rogers 5840*. (The first set of each of the above collections is deposited in the Herbarium of the University of Michigan.)

University of Texas, Austin.

#### LITERATURE CITED

- CARD, H. H. 1931. A Revision of the Genus *Frasera*. *Ann. Mo. Bot. Gard.* 18: 245-282.  
 ST. JOHN, HAROLD. 1941. Revision of the Genus *Swertia* (Gentianaceae) of the Americas and the Reduction of *Frasera*. *Am. Midland Nat.* 26: 1-29.

### STUDIES IN WESTERN VIOLETS, VI

MILo S. BAKER

The largest number of *Viola* species in the western part of the United States belong to the *Chamaemelanium* section, most species of which have yellow or yellowish flowers. The largest group of these is the *Nuttallianae*, which contains two large species complexes, the *Viola purpurea* and the *V. Nuttallii* complexes. Each of these groups has representatives over most of the western United States, where they occupy numerous ecological niches. The more versatile of the two is the *V. purpurea* group, which occurs from near the coast of the Pacific to nearly 11,000 feet altitude in the mountains and also across the ranges and flats of the arid Great Basin.

Three species are recognized in the *V. purpurea* complex: *V. quercetorum* Baker and Clausen of the Coast Ranges and foothills of California and adjacent Oregon; *V. purpurea* Kell., with 8 subspecies occupying ecologically very different niches in the Sierra Nevada and the Great Basin; and *V. aurea* Kell., with 3 subspecies in the Great Basin. A more remote relative of the *V. purpurea* complex is *V. pedunculata* Torr. and Gray of the California Coast Ranges, with two subspecies.

The *Viola Nuttallii* complex contains the following species: *V. Nuttallii* Pursh, *V. vallicola* A. Nels., *V. Bakeri* Greene, with two, and *V. praemorsa* Dougl., with five subspecies. More remotely related are the rare endemics, *V. tomentosa* Baker and Clausen, *V. charlestonensis* Baker and Clausen, and *V. utahensis* Baker and Clausen.

The present paper treats the subspecies of *V. purpurea* and *V. pedunculata* and proposes two new combinations in *V. praemorsa*. A forthcoming paper will cover the remaining units of the *Nuttallianae*.

Cytological investigation of the group was carried on by Dr. Jens Clausen of the Division of Plant Biology of the Carnegie Institution of Washington, at Stanford. We collaborated in working out a tentative classification of the *Nuttallianae* and in testing it in the field and in the garden. Satisfactory chromosome counts have been secured for all but one of the entities in this group.

I desire to express my appreciation of the kindness of the curators who loaned us material from the United States National Herbarium (US), Gray Herbarium (GH), New York Botanical Garden (NY), Chicago Natural History Museum (F), Stanford University (DS), Pomona College (POM), University of California at Berkeley (UC), California Academy of Sciences (CAS), Missouri Botanical Garden (MO), State College of Washington (WTC), Academy of Natural Sciences of Philadelphia (PH), and Willamette University (WILLU).

Special thanks go to Dr. Jens Clausen and Dr. David D. Keck for invaluable advice and assistance in the preparation of this and the other publications on this group.

For the drawings of pistils, stamen-sheaths and seeds, I am indebted to Mrs. N. Bunyan (née Vanette Ott).

*VIOLA PURPUREA* Kell. Proc. Calif. Acad. Sci. 1: 55. 1855.

Plants with a strong woody taproot from the lignified rootstock but few if any adventitious roots; stems conspicuous even during the flowering season; first leaves  $\pm$  rounded  $\pm$  purple-tinted, particularly on lower surface, more succulent and differently margined than the later leaves; herbage microscopically puberulent throughout; peduncular bractlets minute, filiform, subopposite or somewhat separated; flowers bright yellow on the face, purple-tinted on back of the upper petals, varying somewhat in size between subspecies, the spur uniformly short, 1-2 mm. long, the lateral petals clavate-bearded; sepals linear-lanceolate with inconspicuous auricles, glabrate to densely puberulent, or ciliate; style length somewhat various; ovary microscopically puberulent; style with conspicuous flexure near the ovary and a capitate head with retrorse bearding on each side; stigma a minute lip terminating the head; capsule nearly spherical, microscopically puberulent; seeds more nearly spherical than in the other species of *Nuttallianae*. The caruncle does not project beyond the point of the seed but is much the same in all the subspecies except *venosa* and *atriplicifolia* in which it has a peculiarly flattened and fluted appearance when dry. The stamen sheath and its collar-opening is similar in form but varies in size for the different units of the *V. purpurea* complex. It is fully explained elsewhere (Madroño 3: 52, 53, and 57, 1935). (See also figs. 9, 12, 13, 14, pl. 8).

*VIOLA PURPUREA* subsp. *typica* Baker and Clausen, nom. nov.  
*V. purpurea* Kell. Proc. Calif. Acad. Sci. 1: 55. 1855.

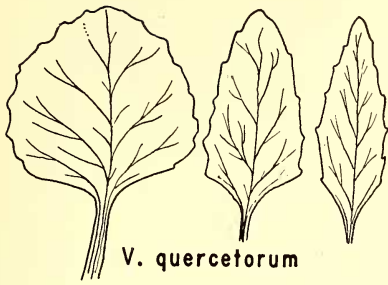
In strong light a depressed plant, in shade more or less erect, 6–19 cm. high; early foliage green but more strongly purple-tinted and more succulent than in the other subspecies, glabrate on upper surface; main stems 1–8, at flowering stage 4–19 cm. long, later in season longer; radical leaves 1–5, orbicular, margination irregular, 1.6–3 cm. wide, 1.8–3.5 cm. long, on petioles 4–11 cm. long (pl. 4), the stipules  $\pm$  scarious, adnate to petiole, free tip triangular to lanceolate, 2–3 mm. long; upper cauline leaves ovate, more regularly crenate-serrate, becoming microscopically puberulent throughout, the stipules foliaceous, very unequal even for the same leaf, mostly ovate to oblong, coarsely toothed, 1.5–5 mm. wide, 3–14 mm. long; peduncles 3–10 cm. long, exceeding the leaves, the bractlets filiform, mostly above the middle, never near the flowers, 2–5 mm. long; sepals glabrate to ciliate or densely short-puberulent, 1–1.3 mm. wide, 4–6 mm. long; style 2.1 mm. long; capsule 5–6 mm. in diameter; seeds dark brown (table 1).

Kellogg's species is without a type specimen, but there is a water color sketch of a portion of a fresh specimen from Placerville, California, drawn by Dr. Kellogg in 1855 and deposited at the California Academy of Sciences, San Francisco. The marked purple color of this plant identifies it as *V. purpurea* rather than *V. quercetorum* Baker & Clausen. Two markings shown in the drawing mentioned above, however, do not occur in any plants I have examined, namely, the purple color of the stigma and three purple stripes upon the capsule.

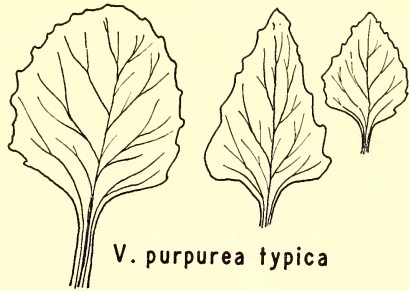
In the absence of a type for *Viola purpurea*, I wish to propose as a lectotype the following specimen which comes nearest to my conception of Dr. Kellogg's plant: With scattered yellow pines, along Highway 36, 2 miles west of Paynes Creek, Tehama County, California, altitude 1800 feet, *M. S. Baker 8655* (widely distributed to herbaria in the United States). This collection came from a low elevation for subsp. *typica*, being well within the elevational range of *V. quercetorum*, but a bud fixation showed that it has six pairs of chromosomes, the *V. purpurea* number.

In the field, subspecies *typica* can be distinguished from *V. quercetorum* by its greener aspect, more purple tinting throughout, somewhat smaller flowers, capsules and seeds, less vigorous growth and the somewhat narrower leaves, most noticeably in the small upper ones as illustrated in plate 4.

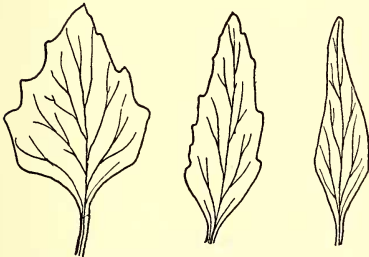
*Viola purpurea* subsp. *typica* seems almost invariably to be associated with yellow pine and occupies the Lower Transition Life Zone. It, together with subspecies *mesophyta*, *dimorpha* and *geophyta* should be known as the yellow pine violet. At the northern end of the Sacramento Valley the lower limit of the



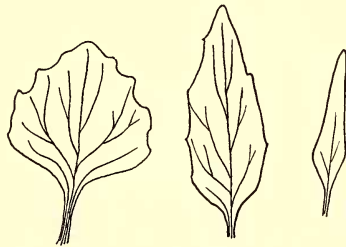
*V. quercetorum*



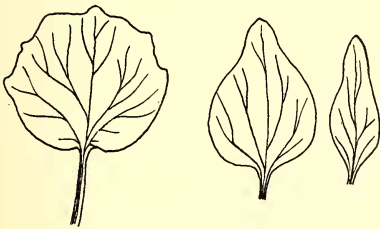
*V. purpurea typica*



*V. purpurea mesophyta*



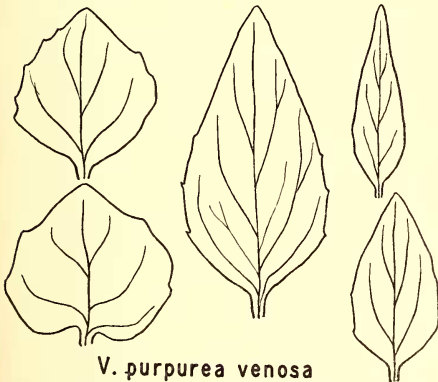
*V. purpurea xerophyta*



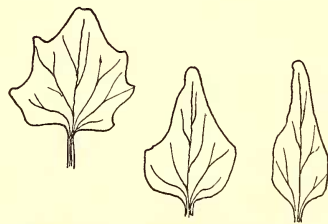
*V. purpurea integrifolia*



*V. purpurea dimorpha*



*V. purpurea venosa*



*V. purpurea atriplicifolia*

PLATE 4. LEAF OUTLINES OF SUBSPECIES OF VIOLA PURPUREA KELL. Figures at left are earliest basal leaves, those at right, upper leaves. All  $\times 1$ .



yellow pine belt is around 2000 feet. From here *V. purpurea* subsp. *typica* may extend upward several thousand feet in altitude before being replaced by other subspecies.

A belt of *Viola purpurea* subsp. *typica*, generally just above a belt of *V. quercetorum*, may be found from the Mexican border, through the mountains of southern California and along the western slope of the Sierra Nevada, nearly to the western slope of Mount Lassen, thence northwesterly nearly to Mount Shasta and the Siskiyou Mountains. In the Coast Ranges it is found on Mount Pinos and the higher peaks of the San Rafael Mountains, but thus far has not been collected elsewhere to the north until Lake County is reached. Here it has been found on Mount Sanhedrin and Snow Mountain, and it doubtless grows on Mount Hull and Sheetiron. It has been collected in association with *V. quercetorum* on Elk Mountain at 4100 feet, on Mount Hanna, and at Loch Lomond, Lake County, at 2500 feet, the lowest elevation known for it in the Coast Ranges. At the south end of this lake *V. quercetorum* is abundant, while at the north end typical *V. purpurea* grows but is less abundant. This is one of the few places where the two have been observed growing side by side. No intergrading has been observed, due no doubt to their different chromosome numbers. Doubtless a considerable belt of *V. purpurea* subsp. *typica* may be found on the Yollo Bollys. In the Siskiyou, as well as in the Salmon and Trinity mountains, it has been found at the proper elevation. In the Arid Transition, north and northeast of Mount Shasta and into Oregon, subsp. *typica* is almost wholly replaced by subsp. *dimorpha*.

The altitudinal limits of subsp. *typica* are marked by the collections from Paynes Creek, Tehama County, at 1800 feet, and Cisco Grove, Placer County, at 6000 feet.

VIOLA PURPUREA subsp. *mesophyta*<sup>(PECK, M. E.)</sup> Baker and Clausen, subsp. nov. Planta silvicola virescens; a subsp. *typica* differt foliis erectissimis longe petiolatis, imis parvis plus minusve profunde et remote dentatis, superioribus angustis integris usque ad 5.8 cm. longis 1.7 cm. latis.

Erect green plants of coniferous forests, differing from subsp. *typica* in the strictly erect leaves, only the earliest being thick and purple-tinted and the upper being narrower, sharper, and more nearly entire, even the radical leaves (except the very earliest) are thin, elongated, with a sharper more irregular dentation and longer petioles 2.8–13 cm. long, their blades mostly ovate-lanceolate, occasionally ovate, few or none as wide as long (pl. 4), 5–22 mm. wide, 16–35 mm. long, the cauline narrower, undulate-denticulate to occasionally entire, ovate-lanceolate to oblong-lanceolate, occasionally 5 times as long as wide, 5–17 mm. wide, 2–5.8 cm. long, the petioles progressively shorter

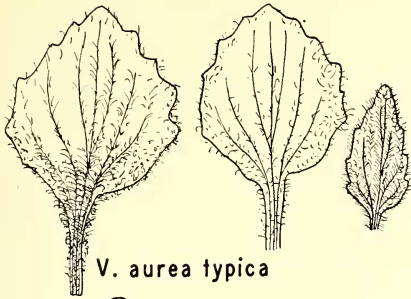
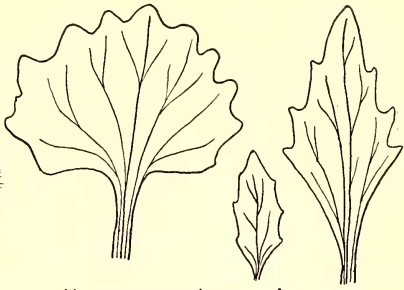
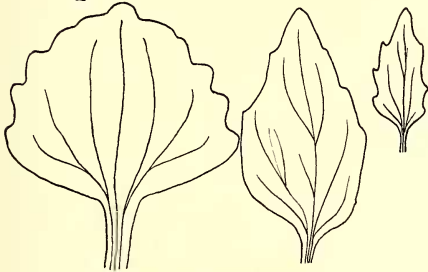
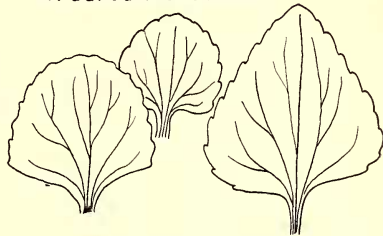
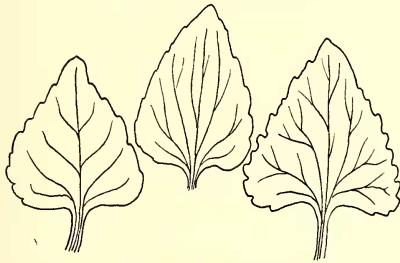
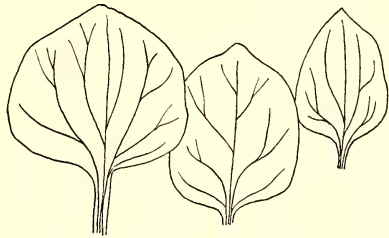
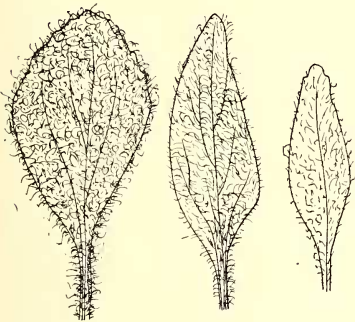
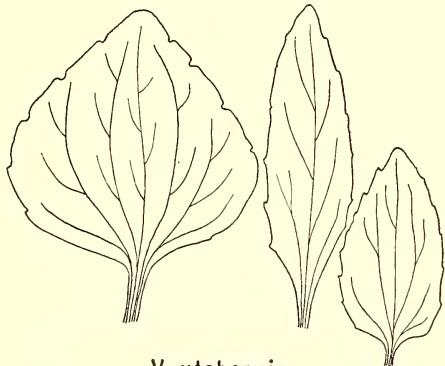
*V. aurea typicala**V. aurea mohavensis**V. aurea arizonensis**V. pedunculata typicala**V. pedunculata tenuifolia**V. charlestonensis**V. tomentosa**V. utahensis*

PLATE 5. LEAF OUTLINES OF SPECIES OF VIOLA, SECTION NUTTALLIANAE OTHER THAN *V. PURPUREA*. (*Viola aurea*, illustrated here, will be treated in a forthcoming paper.) Figures at left are earliest basal leaves, those at right, upper leaves. All  $\times 1$ .

upwards; seeds gray, mottled with brown, dimensions and weight as in table; otherwise as in subsp. *typica*.

Type. In the shade of *Abies magnifica*, *A. concolor*, and *Pinus Murrayana*, Porcupine Flat, Yosemite National Park, Mariposa County, California, altitude 8100 feet, July 18, 1935, *J. Clausen 1098* (DS; isotypes: UC, POM, MO, US).

This subspecies grows at a higher elevation than subsp. *typica*, living mainly in the upper Transition and Canadian life zones at elevations from 6000 to 10,500 feet. It is found in coniferous forests from the San Jacinto and San Bernardino mountains to the Mount Pinos region, the Tehachapi Mountains, and along the western slope of the Sierra Nevada as far north as the Feather River region of Plumas County. It is thus restricted entirely to California. Its nearest relative is subsp. *xerophyta* from which it can be distinguished by its greener aspect, longer stems, somewhat wider leaves with more rounded apices, and the forest habitat.

Near its northern limit this subspecies and subsp. *dimorpha* overlap to some extent, and might be confused because of the similarity of the uppermost leaves. A glance at one of the earliest radical leaves, however, will immediately clear up the question of identity, for that of subsp. *dimorpha* is truncate at base and the teeth are obscure or rounded, while that of subsp. *mesophyta* has a cuneate base and the teeth are more acute (pl. 4). Moreover, the uppermost leaves of subsp. *mesophyta* are considerably narrower.

At lower levels subsp. *mesophyta* may occasionally be in contact with subsp. *typica*, but the two may be distinguished both by the earliest radical leaves and the upper leaves, which are quite different (pl. 4).

*VIOLA PURPUREA* subsp. *xerophyta* Baker and Clausen, subsp. nov. *Nana alpina canescens cinerescens* subspeciei *mesophytæ* similis; internodiis brevibus; foliis caulinis undulato-denticulatis, superioribus anguste lineari-lanceolatis.

Alpine dwarf close to subsp. *mesophyta* but smaller, 3–12 cm. above ground, grayer because of denser puberulence, with leaves mostly narrower and stems little developed and mostly buried; taproot large, woody, without adventitious branches from the rootstock; leaves extremely variable in outline and serration but similar to those of subsp. *mesophyta* (pl. 4), the radical few; cauline leaves ovate to ovate-lanceolate or linear-lanceolate, irregularly dentate to lacerate or nearly entire, 7–15 mm. wide, 10–35 mm. long, on petioles 2–6 cm. long, the cauline progressively narrower and more acute and on shorter petioles upwards, undulate, undulate-denticulate, lacerate, or entire; peduncles equaling or much exceeding the leaves; bractlets usually near the middle of the peduncle; flowers small, about 8 mm. in diam-

TABLE I. CHROMOSOME NUMBERS AND SEED CHARACTERS OF VIOLA, SECTION NUTTALLIANAE.

Viola complex	Chromo-	Weight	Length	Width	Caruncle	Color	Luster
	soma no n	mg	mm	mm	length mm		
<i>V. purpurea</i> complex							
<i>V. quercetorum</i>	12	3.29	2.69	1.79	0.64	med. brown	medium
<i>V. purpurea</i>							
<i>typica</i>	6	2.34	2.31	1.45	0.56	dark brown	dull
<i>mesophyta</i>	6	2.75	2.53	1.66	0.58	gray and brown	dull
<i>xerophyta</i>	6	2.51	2.31	1.74	0.28	mottled	dull
<i>integrifolia</i>	6	3.73	2.86	1.96	0.59	gray and brown	dull
<i>dimorpha</i>	6	2.64	2.46	1.80	0.36	dark brown	dull
<i>geophyta</i>	6	2.00	2.37	1.52	0.40	med. brown	dull
<i>venosa</i>	6	2.70	2.35	1.50	0.96	mottled	dull
<i>atriplicifolia</i>	6	2.57	2.41	1.66	0.85	gray and brown	dull
<i>V. aurea</i>							
<i>typica</i>	6	2.15	2.91	1.47	0.85	med. brown	medium
<i>mohavensis</i>	6	2.30	2.73	1.48	0.72	light brown	medium
<i>V. Nuttallii</i> complex:							
<i>V. praemorsa</i>							
<i>typica</i>	18	6.21	3.49	2.09	1.04	light tan	shining
<i>major</i>	24	5.10	3.00	1.83	1.05	med. brown	shining
<i>arida</i>	—	4.08	2.95	1.95	0.90	light tan	medium
<i>oregona</i>	24	3.50	2.88	1.54	0.91	light brown	medium
<i>linguaeifolia</i>	18	4.24	3.25	1.81	1.34	med. brown	shining
<i>V. Bakeri</i>							
<i>typica</i>	24	4.79	3.00	1.77	0.68	med. brown	shining
<i>grandis</i>	24	5.16	3.56	1.98	0.62	dark brown	shining
<i>V. Nuttallii</i>	12	3.00	3.00	1.67	1.00	med. brown	shining
<i>V. vallicola</i>	6	1.70	2.19	1.27	0.78	straw color	medium
<u>Other species</u>							
<i>V. utahensis</i>	12	4.40	2.97	1.65	0.77	med. brown	dull
<i>V. tomentosa</i>	6	2.83	2.67	1.52	0.40	light brown	dull
<i>V. charlestonensis</i>	6	5.04	3.42	2.08	0.50	black	shining
<i>V. pedunculata</i>							
<i>typica</i>	6	4.97	2.68	1.84	0.64	dark brown	shining
<i>tenuifolia</i>	6						

eter; collar-opening longer than in the other subspecies, other details of flowers as in the other subspecies; seeds gray, mottled with brown, dimensions and weight as in table 1.

Type. In open ground along the trail from Mineral King to the Little Kern River, a short distance southwest of Farewell Gap, Tulare County, California, altitude about 10,000 feet,

July 8, 1930, *M. S. Baker 4375* (UC; isotypes: POM, DS, US).

Professor Edward Lee Greene in 1889 collected in the Tehachapi Mountains, Kern County, a violet that later was published as *Viola pinetorum* Greene. In the opinion of Dr. Clausen, this is a hybrid between subspecies *xerophyta* and *mesophyta*, and therefore the name is not available for either of these subspecies.

This subspecies is in arid alpine regions of California from the San Jacinto and San Bernardino mountains to Mount Pinos, Tehachapi Mountains and the crests of the Sierra Nevada as far north as Sierra County, extending from the Upper Canadian through the Hudsonian and into the Boreal Life Zone. One collection (*Parish 1796*) was made at 5000 feet in the San Bernardino Mountains, but usually it grows above 7000 feet, the highest known elevation being 11,000 feet on Olancha Mountain, Tulare County (*Hall and Babcock 5235*).

Attention should be called to some notable variations in this subspecies. One of these occurs in the Sierra Nevada south of Mount Whitney at Golden Trout Creek and elsewhere in this region. The leaves of this form have a markedly lacerate margin and the foliage is unusually canescent due to a dense coat of hairs approaching a tomentum. The leaves are also much narrowed, some being only one-eighth as wide as long. In the mountains of southern California and the Tehachapi there is another very narrow-leaved and highly canescent form of subsp. *xerophyta*.

The nearest relative is subsp. *mesophyta*, which is an inhabitant of forests on the western Sierra Nevada slope, while subsp. *xerophyta* occupies more open and rocky situations and extends to a higher level.

*VIOLA PURPUREA* subsp. *integrifolia* Baker and Clausen, subsp. nov. *Persaepe nana alpina virescens puberula*; caulibus subterraneis; foliis radicalibus orbiculatis irregulariter dentatis, eis summis integerrimis.

Alpine dwarf, mature plants showing on the surface only a clump of leaves a few centimeters high, which completely hide the buried stems; taproot woody, deep-seated, with small secondary roots and an occasional adventitious root from the rootstock; stems one to many, usually deeply buried, developed only slightly above the surface, 2-7 cm. long; herbage microscopically puberulent throughout; earliest leaves horizontal, thick and purple-tinted beneath, green above, undulate or shallowly and irregularly (never deeply) dentate, rotund with subcordate, truncate, or broadly cuneate base, 8-17 mm. wide, 10-18 mm. long, on petioles 3-5 cm. long, the cauline leaves few, smaller, narrower, mostly obtuse with cuneate base, entire, ovate to oblong-lanceolate, 3-10 mm. wide, 9-25 mm. long, on petioles progressively shorter upwards (pl. 4); stipules mostly scarious; peduncles as long as or slightly longer than the leaves, the bractlets mostly near the



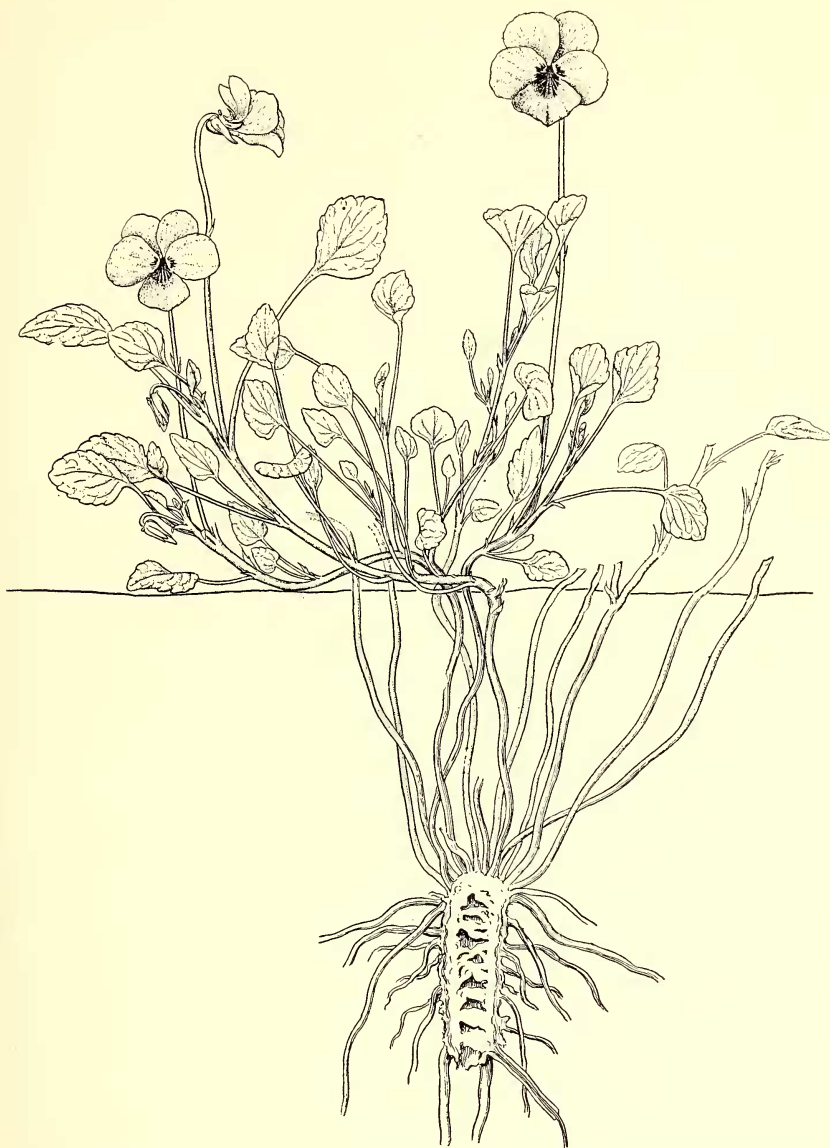


PLATE 6. *VIOLA PEDUNCULATA* TORR. AND GRAY SUBSP. *TYPICA* BAKER AND CLAUSEN.  $\times 0.6$ .

flowers; flowers often smaller than in subsp. *typica* but variable in size, 8–10 mm. in diameter; seeds dull dark brown, dimensions and weight as in table 1.

Type. In *Abies magnifica* forest, on the Humbug Road from Prattville to Chaparral, just north of Humbug Summit, Plumas County, California, near the Butte County line, altitude 6500 feet, June 25, 1935, *Keck & Clausen 3769* (UC; isotypes: CAS, DS, US).

In typical form this subspecies is not usually found below 6000 feet altitude and it extends upward to timber line. The highest known station is Castle Peak, Nevada County, at 8900 feet (*A. A. Heller 7089*). The subspecies is adapted to dry rocky or pumice-covered slopes as evidenced by the enormously long woody taproot. A collection from Crater Lake National Park (*Applegate 9764*) shows a taproot broken off at 20 cm. beneath the surface and a much greater length is indicated. The deeply buried buds of this subspecies enable it to withstand the extreme temperatures of high elevations.

Geographically subsp. *integrifolia* extends from Inyo and Mariposa counties north along the arid crests of the Sierra Nevada in California and the high peaks of Ormsby and Washoe counties, Nevada, to Mount Lassen, Mount Shasta, and the alpine peaks of Klamath County, Oregon. In the elevated regions about Crater Lake and south it is quite common. It also extends southward from Siskiyou County into the high peaks of the inner Coast Range where it presents a somewhat different appearance. It has been collected at 7000 feet on Snow Mountain, Anthony Peak, Mendocino County, and at the 6750 foot summit of the Covelo-Williams highway in Glenn County. In the region about this summit it is the only form of *Viola purpurea* and is abundant from 6000 to 7000 feet.

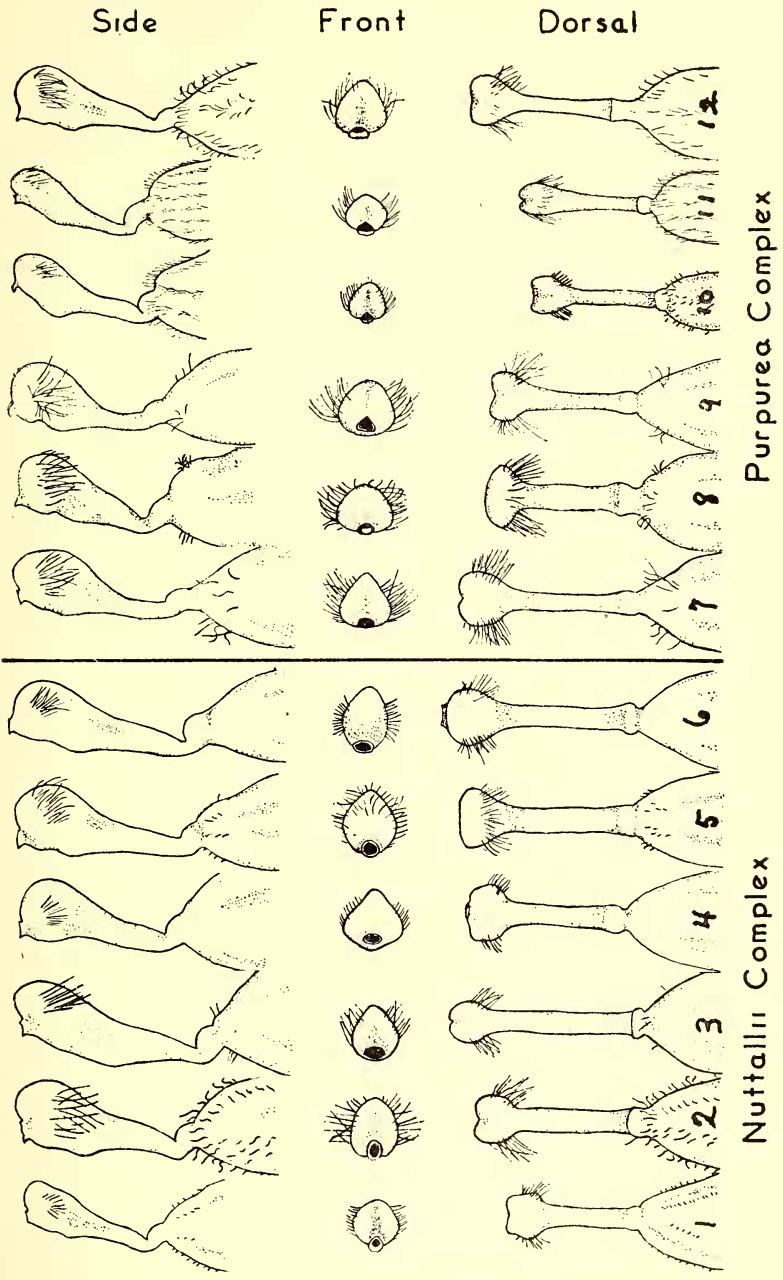
In the northern Sierra Nevada this subspecies replaces subsp. *xerophyta* at alpine levels. Though these forms overlap in the central Sierra Nevada, there is never any difficulty distinguishing them because of the greener aspect and the obtuse leaf apices of subsp. *integrifolia*.

At some points along the western borders of the Great Basin, subspecies *integrifolia* and *dimorpha* are found growing near one another. Except in northern California the entire margins of the

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EXPLANATION OF THE FIGURES. PLATE 7.

PLATE 7. PISTILS OF VIOLA, SERIES NUTTALLIANÆ. FIGS. 1–6, *V. Nuttallii* complex: 1, *V. vallicola* A. Nels.; 2, *V. praemorsa* Dougl. subsp. *oregona* Baker and Clausen; 3, *V. Bakeri* Greene subsp. *typica* Baker and Clausen; 4, *V. Nuttallii* Pursh; 5, *V. praemorsa* Dougl. subsp. *linguaefolia* (Nutt. ex Torr. and Gray) Baker and Clausen; 6, *V. praemorsa* Dougl. subsp. *typica* Baker and Clausen. FIGS. 7–12. *V. purpurea* complex: 7, *V. quercetorum* Baker and Clausen; 8, *V. aurea* Kell. subsp. *typica* Baker and Clausen; 9, *V. aurea* Kell. subsp. *mohavensis* Baker and Clausen; 10, *V. purpurea* Kell. subsp. *xerophyta* Baker and Clausen; 11, *V. purpurea* Kell. subsp. *mesophyta* Baker and Clausen; 12, *V. purpurea* Kell. subsp. *typica* Baker and Clausen. All  $\times 10$ .



Purpurea Complex

Nuttallii Complex

PLATE 7. PISTILS OF VIOLA, SERIES NUTTALLIANÆ.

upper leaves distinguish subsp. *integrifolia*. However, in Shasta, Modoc and Siskiyou counties the upper leaves of subsp. *dimorpha* tend to have entire margins and in such a case the two subspecies are distinguished by the caulescent habit of subsp. *dimorpha*.

Discussion of this subspecies should not be concluded without comment on the peculiar form to be found about Lake Tahoe, Truckee, Hobart Mills, Webber Lake and Gold Lake. Here subsp. *integrifolia* may reach a height of 17 cm. above the soil with stems nearly as long. In the shade of the dense forests of this region the winter buds are not so deeply buried, hence the stems are mainly aerial. The aspect of these plants is wholly different from that of plants at higher elevations.

*VIOLA PURPUREA* subsp. *dimorpha* Baker and Clausen, subsp. nov. *Planta silvicola virescens tarde conspicue caulescens; foliis radicalibus orbiculatis basi truncatis, summis saepe integerrimis.*

Foliage greenish as in subsp. *typica*, 3–25 cm. high; early leaves rotund, truncate at base, on petioles 2–8.5 cm. long, later leaves narrowly ovate to lanceolate, obtuse to acute, truncate or slightly cuneate at base, repand-denticulate to entire, some, as season advances, 2.5–3 times as long as wide, 7–15 mm. wide, 15–30 mm. long; seeds dull brown, variable in size and form, dimensions and weight as in table.

Type. In yellow pine, white fir and incense cedar forest, near the Mineral-Chester highway, Child's Meadows, Plumas County, California, altitude about 5000 feet, June 26, 1935, *M. S. Baker 8100* (UC; isotypes: DS, CAS, US, NY, GH, F).

This subspecies has a wide distribution in the coniferous forests bordering the Great Basin from Deschutes County, Oregon, southward through Siskiyou, Modoc, Lassen and Plumas counties, California, and along the eastern slope of the Sierra Nevada as far south as Inyo County, California.

It should be borne in mind that subsp. *dimorpha* is a forest or

EXPLANATION OF THE FIGURES. PLATE 8.

PLATE 8. *VIOLA*, SERIES *NUTTALLIANAE*. FIGS. 1–7. Pistils, side, front, and dorsal views: 1, *V. praemorsa* Dougl. subsp. *major* (Hook.) Baker and Clausen; 2, *V. Bakeri* Greene subsp. *grandis* Baker and Clausen (1 and 2 belong to the *V. Nuttallii* complex); 3, *V. tomentosa* Baker and Clausen; 4, *V. utahensis* Baker and Clausen; 5, *V. charlestonensis* Baker and Clausen; 6, *V. pedunculata* Torr. and Gray subsp. *tenuifolia* Baker and Clausen; 7, *V. pedunculata* Torr. and Gray subsp. *typica* Baker and Clausen. FIG. 8. Side view of pistil, *V. purpurea* Kell. subsp. *dimorpha* Baker and Clausen. FIG. 9. Stamen sheath, *V. tomentosa* Baker and Clausen. FIGS. 10–11. Seeds: 10, *V. quercetorum* Baker and Clausen; 11, *V. purpurea* Kell. subsp. *atriplicifolia* (Greene) Baker and Clausen. FIGS. 12–14. Stamen sheaths: 12, *V. Bakeri* Greene subsp. *typica* Baker and Clausen; 13, *V. praemorsa* Dougl. subsp. *typica* Baker and Clausen; 14, *V. pedunculata* Torr. and Gray subsp. *tenuifolia* Baker and Clausen. FIG. 15. Seed, *V. praemorsa* Dougl. subsp. *typica* Baker and Clausen. All  $\times 10$ .

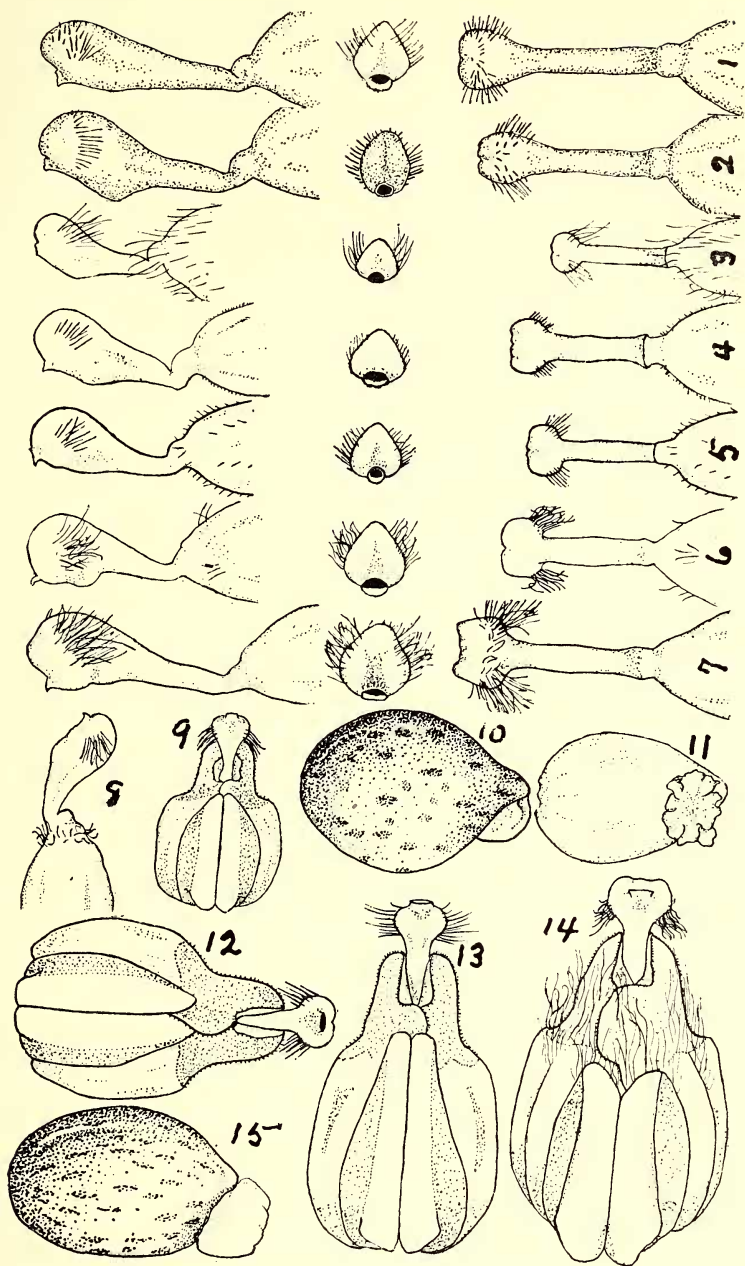


PLATE 8. VIOLA, SERIES NUTTALLIANAE.



shade type, while subsp. *geophyta* inhabits open areas surrounded by forests and is therefore a sun type. Seasonal buds of subsp. *dimorpha* are near the surface, while in subsp. *geophyta* the buds are deeply buried. These two subspecies completely intergrade at several places, however, indicating that possibly they represent but environmental forms of one unit.

Subspecies *dimorpha* shows wide variation. Early in the season the first flowers appear when the plant is extremely small and possesses few other than basal leaves. Later in the season it may be many times higher, with the rounded basal leaves all fallen and only the narrow nearly entire cauline leaves present, thus making the plant appear like an entirely different species. It is to this peculiar characteristic of the plant that the proposed subspecific name calls attention.

At the height of the flowering season subsp. *dimorpha* often closely resembles subsp. *typica* in regions where the ranges of the two overlap. However, subsp. *dimorpha* can be easily distinguished by the truncate or subcordate base of the earliest leaves, and by the narrower, more acute and more nearly entire upper leaves.

Occasionally a plant of subsp. *dimorpha* is found which may be confused with subsp. *mesophyta*, the later leaves being often very similar. In such a case, the early leaves serve to distinguish them, for the radical leaves of subsp. *dimorpha* are truncate or subcordate basally, while those of subsp. *mesophyta* are cuneate basally.

**VIOLA PURPUREA** subsp. *geophyta* Baker and Clausen, subsp. nov. Planta caespitosa acaulescens usque ad 5 cm. alta plus minusve cinerescens (glabrata usque ad fere canescens); foliis radicalibus orbiculatis basi truncatis, summis plus minusve dentato-serratis; hibernaculis valde subterraneis.

A low-growing geophyte with little stem development and that largely subterranean, caespitose, seldom more than 5 cm. high above ground, scarcely hairy and light green to almost canescent; root system woody, variable, but commonly with one or more adventitious branches from the rootstock; primary stems 1-6, from tip of deep-seated vertical rootstock, 2.5-8 cm. long, erect or ascending; lowest leaves (both radical and cauline) rounded, thick, purplish, coarsely, deeply and bluntly dentate, the blade commonly broader than long, 1-3.4 cm. wide, 1-2.8 cm. long, on petioles 2.5-8 cm. long, the cauline leaves progressively smaller, sharper, and grayer upwards, ovate to ovate-lanceolate,  $\pm$  sharply but not deeply dentate-serrate; stipules of radical leaves scarious, the free tip nearly obsolete, of cauline leaves mostly scarious and shrivelled but occasionally foliaceous above; peduncles of petaliferous flowers longer than the leaves, those of the more numerous cleistogamous flowers short and  $\pm$  subterranean, the bractlets scarious, nearly obsolete, near the middle; flowers and capsules

smaller than those of subsp. *typica*; seeds dull brown, finely mottled with gray, dimensions and weight as in table.

Type. In volcanic ash, yellow pine and lodge-pole pine forest, 20 miles south of Lapine on the road to Silver Lake, Deschutes National Forest, Klamath County, Oregon, altitude about 4000 feet, June 23, 1935, *Keck & Clausen 3707* (UC).

This subspecies is found in open flats of the coniferous forests along the western border of the Great Basin from Deschutes County, Oregon, southward through northern California and along the eastern slope of the Sierra Nevada as far as Mono and possibly Inyo County. Its buds are protected in winter by a layer of soil several inches in thickness. The older plants form low spreading mounds of what appear to be only leaves topped with a few flowers. Still later in the season the short stems are full of short-peduncled capsules from apetalous flowers. These cleistogamous capsules are seldom as high as the leaves when ripe and often are beneath the soil.

This subspecies is closely allied to subsp. *dimorpha* with which it sometimes intergrades as mentioned above. Both subspecies range from 4000 to 8000 feet in elevation. Three principal differences separate them: subsp. *geophyta* has more deeply buried seasonal buds, very little stem development, and a greater serration of the uppermost leaves.

Subspecies *geophyta* differs from subsp. *atriplicifolia*, which it occasionally contacts on the east and northeast, in growing at a somewhat lower elevation and in having its stems invariably buried, while subsp. *atriplicifolia* varies in this respect. The leaves of the latter subspecies are more sharply, deeply and irregularly notched, resulting in shapes reminiscent of some *Atriplex* leaves.

VIOLA PURPUREA subsp. *venosa* (Wats.) Baker et Clausen, comb. nov. *V. Nuttallii* var. *venosa* Wats. Bot. King's Expl. 35. 1871. *V. aurea* var. *venosa* Wats. in Brewer & Wats. Bot. Calif. 1: 56. 1876. *V. praemorsa* var. *venosa* Gray, Syn. Fl. 2: 200. 1895. *V. venosa* Rydb. Mem. N. Y. Bot. Gard. 1: 262. 1900. *V. purpurea* var. *venosa* Brain. Vt. Agric. Exp. Sta. Bull. 224: 111. 1921. *V. Thorii* A. Nels. Bot. Gaz. 30: 193. 1900. *V. atriplicifolia Thorii* A. Nels. Coult. & Nels. Man. Bot. Rocky Mts. 321. 1909.

Similar to subsp. *typica* except basal leaves slightly smaller, occasionally more deeply and regularly dentate, later leaves somewhat larger, more abundant, narrower and sharper at apex, the margin not so deeply broken, often entire; pubescence usually shorter, often consisting of mere points as if sanded; peduncles in fruit often recurved towards the ground; seeds dull brownish, variable in size, dimensions and weight as shown in table, the caruncle large, wide-spreading but thin, and when dry, flattened and fringed around margin, variable in size, up to 1 mm. in diameter.

The type was collected in the West Humboldt Mountains, Nevada, and the subspecies ranges from Nevada to the Wasatch Mountains, Utah, Colorado (one outlying station at Steamboat Springs, Routt County), thence northward through Wyoming to Montana, and westward through Idaho to eastern Washington. It has not as yet been found in eastern Oregon, but is to be expected there. Its elevational range is from 5000 to 10,000 feet. Except at high altitudes it grows in dense shade of forests or brush. Such shade conserves the necessary moisture to permit a longer seasonal growth, resulting in longer stems and a greater proportion of cauline leaves.

This subspecies is most baffling because of the wide variation in leaf-shape (pl. 4). The two drawings on the left represent two types of basal leaves. There is scarcely a leaf form of the *Viola purpurea* complex of the Pacific Coast that cannot be duplicated in this subspecies. Watson's type is very close to subsp. *typica* or subsp. *integrifolia*, but plants from lower elevations often have large cauline leaves which may be entire or obscurely dentate. Again, the cauline leaves may be small and greatly elongated as at the right in the plate. There is no fixed pattern in leaf outline (pl. 4) nor any other definite character except for the peculiarly flattened and fringed type of caruncle which is the same as that in subsp. *atriplicifolia* (pl. 8, fig. 11).

As shown by the synonymy, this unit has been placed by various authors under five different species, but in my opinion Brainerd was correct in classifying it as a subunit under *V. purpurea*. It has but one constant difference separating it from *V. purpurea* subsp. *typica*, and that is in the form of the caruncle of the seed. A minor difference such as this cannot justify specific separation.

The nearest relative of subsp. *venosa* is subsp. *atriplicifolia*. Both are confined to the Great Basin region and both extend to near timber line. Each has the same peculiar spreading caruncle (when dry) and a similar pubescence. They differ mainly in the leaf outline.

*VIOLA PURPUREA* subsp. *atriplicifolia* (Greene) Baker and Clausen, comb. nov. *V. atriplicifolia* Greene, Pittonia 3: 38. 1896.

Closely allied to subsp. *venosa* but early leaves more sharply dentate, in some cases nearly lobed, the later leaves triangular, acute, coarsely and irregularly dentate to quite entire; stem development small, never exceeding the height of the radical leaves; seasonal buds vary greatly in depth, being deeply buried at one locality and near the surface at another; in other details as in subsp. *venosa*.

Type. Dry hills near Mammoth Hot Springs, Wyoming, Yellowstone Park, altitude 6500 feet, June 1893. *F. H. Burglehaus* (US).

This subspecies has a wide distribution, mostly at fairly high elevations from 6000 to 10,000 feet (rarely as low as 5000 or even 4500 feet), from Wyoming to Idaho and southeastern Washington, southward through eastern Oregon and Nevada to Ashland Butte, the Warner Mountains of California and the eastern slopes of the Sierra Nevada as far south as Inyo County, California.

A shade form of this subspecies deserves comment for it presents a very different appearance from the plants of more open ground. The early, largely radical, leaves have greatly elongated petioles (in an extreme case 16 cm. long), and the somewhat elongated stems are feeble, bearing tiny leaves. The early leaves lack the distinct notching of the sun form; instead their irregular notches are greatly rounded, suggesting an undulate margin. Moreover, their blades are much larger, being up to 2-3 cm. in width and length, yet the cauline leaves are not larger but may be very narrow and much overtopped by the elongated basal leaves. The following collections represent this seldom collected shade form: Wallowa Mountains of northeastern Oregon, *Cusick 3074*; Ashland Butte, Jackson County, Oregon, *Applegate 5462, 5498*; western slope of the Warner Mountains, Modoc County, California, *Applegate 7960*.

*VIOLA PEDUNCULATA* subsp. *typica* Baker and Clausen, nom. nov. *V. pedunculata* Torr. and Gray, Fl. N. Am. 1:141. 1838.

*VIOLA PEDUNCULATA* subsp. *tenuifolia* Baker and Clausen, subsp. nov. A subsp. *typica* differt foliis tenuibus, superioribus vix longioribus quam latis; sepalis longioribus angustioribus acutioribusque; corollis flavis haud aurantiacis parvioribus; stylo brevioribus 2.1 mm. longo.

Subspecies *tenuifolia* differs from subsp. *typica* in having thinner, smaller, more acute leaves of deltoid outline, most of them being longer than wide (pl. 5). The leaves of subsp. *typica* are ovate, obtuse, and approximately as broad as long. The flowers of subsp. *tenuifolia* are often smaller than those of subsp. *typica*, sometimes not larger than those of *V. quercetorum*. At the type locality, the flowers are yellow, not orange as in subsp. *typica*. The sepals are narrower, longer, and more acute. The style is only 2.1 mm. long, while that of subsp. *typica* is 2.9 mm. Style length is one of the most dependable characters in the Nuttallianae. Also the style is conspicuously bulged downward just back of the stigmatic lip.

Type. Associated with oak and digger pine, along highway to Tres Pinos, 4 miles easterly from Pinnacles Lodge, San Benito County, California, altitude 1100 feet, April 5, 1939, *M. S. Baker 9267* (UC; isotypes: DS, POM, US, F, NY, GH).

This subspecies was found to be abundant in the Pinnacles region in rocky uplands rather than in good deep clay or bottom land soil such as that on which subsp. *typica* is found. It was



found growing in scattered colonies nearly to the top of Chalone Mountain, which is 3287 feet high.

Throughout most of its range *Viola pedunculata* exhibits very constant characters. In this area, however, subsp. *typica* does not occur but is to be found contiguous to subsp. *tenuifolia* on its south, west and north borders.

In 1902 C. A. Purpus collected *V. pedunculata* at Springville in Tulare County. Because this species had not before been reported outside the coastal area the data on the Purpus specimen were questioned. In March, 1943, Miss Ella Carter collected material from the Crawford Ranch, six miles below Trimmer Springs in Fresno County. Both of these collections are the subsp. *tenuifolia* and there seems no reason to further question the Purpus collection. These occurrences add another species to the growing list of Coast Range plants that have disjunct ranges between the Coast Ranges and the southern Sierra Nevada foothills.

In the Tertiary there was an arm of the ocean extending into the San Joaquin Valley in the region where this violet has been collected. This may explain its presence as small relict colonies in an arid region where it is possibly doomed to final extinction.

*VIOLA PRAEMORSA* Dougl. subsp. *linguaefolia* (Nutt. ex Torr. and Gray) comb. nov. *V. linguaefolia* Nutt. ex Torr. and Gray, Fl. N. Am. 1: 141. 1838.

*VIOLA PRAEMORSA* Dougl. subsp. *major* (Hook.) comb. nov. *V. Nuttallii* var. *major* Hook. Fl. Bor. Am. 1: 79. 1830.

Kenwood, California

## NEWS AND NOTES

**DISPOSITION OF THE WILLIS LINN JEPSON ESTATE.** The estate of Willis Linn Jepson who died on November 7, 1946, was recently accepted by the Regents of the University of California for the Department of Botany on the Berkeley Campus. The will provides an endowment fund of \$320,000 and stipulates that it be used for the care and maintenance of the Jepson herbarium (estimated at 40,000 specimens) and library, the completion of the "Flora of California," the revision of the "Manual of the Flowering Plants of California," and the furtherance of studies on the flowering plants of California and adjacent areas. The research funds are to be administered for the Regents by a committee whose initial membership, as set up in the will, comprises Dr. Alva R. Davis, Professor of Botany and Dean of the College of Letters and Science as chairman, Dr. Helen Mar Wheeler, Research Associate in Botany, and Dr. Lincoln Constance, Professor of Botany. One of the foremost tasks of this committee will be to see that this invaluable material, the basis for Dr. Jepson's published works, is properly mounted and housed.  
—L. CONSTANCE.